DOCUMENT RESUME

ED 268 244 CE 043 929

AUTHOR	Carr, Linda
TITLE	Looking at Figures. Supervising: Technical Aspects of Supervision. The Choice Series #30. A Self Learning Opportunity.
INSTITUTION	Northern Regional Management Centre, Washington (England).
SPONS AGENCY	Manpower Services Commission, London (England).
REPORT NO	ISBN-0-948023-05-8
PUB DATE	85
NOTE	67p.; For related documents, see ED 266 310-312 and CE 043 921-948.
AVAILABLE FROM	Northern Regional Management Centre, Derwent House, Washington Town Centre, Washington, Tyne & Wear NE38 7ST, England ($15.00 plus postage; 15% discount on 50, 25% on 100; includes audiotape).
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Adult Education; Behavioral Objectives; Charts; Comparative Analysis; *Data; *Data Analysis; Diagrams; Graphs; Learning Activities; Management Development; Self Evaluation (Individuals); *Statistical Analysis; Student Evaluation; *Supervision; Supervisor Qualifications; *Supervisory Methods; *Supervisory Training; Tables (Data)
IDENTIFIERS	Data Organization; Great Britain

ABSTRACT

This learning unit on looking at figures is one in the Choice Series, a self-learning development program for supervisors. Purpose stated for the approximately eight-hour-long unit is to enable the supervisor to understand information displayed in charts, tables, and graphs; produce charts, tables, and graphs from figures; compare different sets of figures using diagrams; and calculate measures to summarize a large amount of information. An introduction provides an overview of the unit and lists unit objectives. Parts A through C contain informative material, activities and answer keys, self-checks and answer keys, and a summary. Topics include communicating data, comparing data, and measuring data. Part D contains performance checks--an end check to be completed alone and a tutor check and work-based project. Part E consists of a brief unit review, extensions (print sources of additional information, such as units or sections in books), and a list of references. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

An Open Tech Project

SUPERVISING

TECHNICAL ASPECTS OF SUPERVISION

30: Looking at Figures

ED268244

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

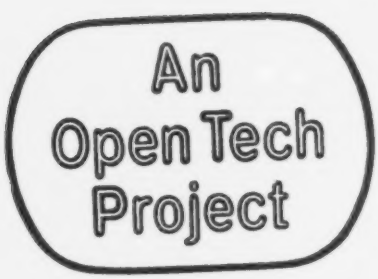
PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

H Pardue

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

30: LOOKING AT FIGURES

Linda Carr



The CHOICE programme is an Open Tech sponsored project managed by the Northern Regional Management Centre in conjunction with the Northern Consortium of Colleges and the National Examinations Board for Supervisory Studies.

© Crown Copyright 1985 Published by permission of the Controller of Her Majesty's Stationery Office.

ISBN 0 948023 05 8

First published in the U K - 1985

Northern Regional Management Centre
Derwent House, Washington Town Centre
Washington, Tyne & Wear NE38 7ST

This Work was produced under an Open Tech contract with the Manpower Services Commission. The views expressed are those of the authors and do not necessarily reflect those of the MSC or any Government Department.

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without permission in writing from the publisher.

Linda Carr
Looking at Figures (Number 30 in the CHOICE SERIES of learning units)

Series Editor: Harry V Pardue
Northern Regional Management Centre.

CONTENTS PAGE

PART A COMMUNICATING DATA

1 Introduction 2

2 Presenting Data 2

3 Summary 18

PART B COMPARING DATA

1 Introduction 19

2 Comparison methods 19

3 Detailed Bar Charts 26

4 Graphs 34

5 Summary 39

PART C MEASURING DATA

1 Introduction 40

2 Summarising Data 40

3 Spread of Data 46

4 Summary 49

PART D PERFORMANCE CHECKS

1 End Check 50

2 Tutor Check 54

3 Work-based Project 57

PART E UNIT REVIEW

1 Return to Objectives 58

2 Extensions 59

3 References 60

WORKING GUIDE TO THIS UNIT IN YOUR DEVELOPMENT PROGRAMME

This Unit is now your personal property - it's not for handing back to your training officer or to a tutor. It is your working book.

The Contents will increase in value to you each time you write on one of its pages. This is a working text for your personal notes - without notes its value is limited.

Qualifications forget about certificates and diplomas - you don't need them for this programme. What you do need is the wish:-

* to do your job better
* for personal development

Your study time is really up to you - we guess you will need about 8 hours in total. But it's your time - spend as long as you like.

How am I doing? you can judge for yourself by checking out how well you cope with the tasks we call Activities and Self Checks which occur throughout the unit. You can also get the Tutor Check and/or the Work Based Project to your tutor for an unbiased view of your progress.

Work Pace it's really up to you and depends on your interest. However, if you do well on the Activities and Self Checks, you could afford to speed up a little. Of course, if you don't do as well as you expect then you could slow down a little or flick back into the unit for a quick review of the more difficult ideas.

When in doubt - ask or seek help from:

* your family and friends
* colleagues at work
* your company training staff
* other open learners
* your tutor, by phone, by a visit to your support centre or by dropping your tutor a line through the post.

Don't worry if what you learn doesn't seem to be of use to you now, remember that times change - it may be useful one day. Anyway, just knowing more improves personal confidence.

So now make a start:-

30: LOOKING AT FIGURES by Linda Carr

ABOUT THIS UNIT

As a supervisor you will often have to handle information in the form of numbers. These numbers may relate to your workteam: for example numbers of individuals sick or on holiday in a given period, or they may relate to your job, for example, output or sales figures.

The figures which you deal with may be presented to you in many different ways, for example, tables, graphs or charts. On the other hand, you may collect the information yourself and want to choose a suitable way to present it to someone else.

This unit is designed to help you understand the figures you deal with in whatever form they appear, and to be able to choose for yourself the best way of presenting them to others.

IN THIS UNIT WE WILL:

* Look at ways of displaying figures.
* Look at the different uses of charts, tables and graphs.
* Compare different sets of figures using diagrams.
* Look at ways of summarising figures using measures such as averages and ranges.

AUDIO TAPE Side 1

Before you continue through the unit, you should now listen to Side 1 of the audio tape that accompanies the unit. You will find it useful if you refer to the unit objectives shown below whilst you listen to the tape.

OBJECTIVES

When you've worked through this unit you will be BETTER ABLE to:

* **Understand information displayed in charts, tables and graphs.**
* **Produce charts, tables and graphs from figures which you have collected.**
* **Choose suitable diagrams to compare different sets of figures.**
* **Calculate suitable measures to summarise a large amount of information.**

PART A COMMUNICATING DATA

1 Introduction

Most days of our life we deal with figures of one sort or another. We may be paying our bills, adding up the score in a darts match or looking at the children's exam marks. When we watch the news we may be told about the Retail Price Index, the latest strike figures or which company is selling the most cars. We often have to deal with figures at work as well.

ACTIVITY 1
Time guide
2 mins

Note down some examples of figures you might find at your workplace.

* _____
* _____
* _____

Clearly there are an enormous number of answers so here are just a few examples:

* overtime hours
* sales figures
* sickness rates
* product prices
* wastage rates
* bonus payments
* profit and loss accounts
* numbers of accidents

As we have to deal with so many figures in our working lives it is easy to miss some, or not take in all the information. Let's call this information which conveys numbers or figures DATA, we'll understand each other better if we do.

2 Presenting Data

Next time you watch the television news make a note of the different ways that figures are presented. It's very rare that the newscaster will just read out a list. You are much more likely to see a diagram or chart of some sort. These make it easier for us, the viewers, to take in information in a very short space of time.

In the rest of this unit we will be learning how to understand this information and present it to those we work with, because:

HOW WE PRESENT DATA CAN BE AS IMPORTANT AS THE FIGURES THEMSELVES

EXTENSION 1
Page 59

We'll keep things on a very straightforward and practical level in this unit, but if you feel you'd like to explore some of these methods further, you're invited to take up our first extension to a book which goes into more detail.

So let's look at some useful ways of presenting data.

2.1 Pie Charts

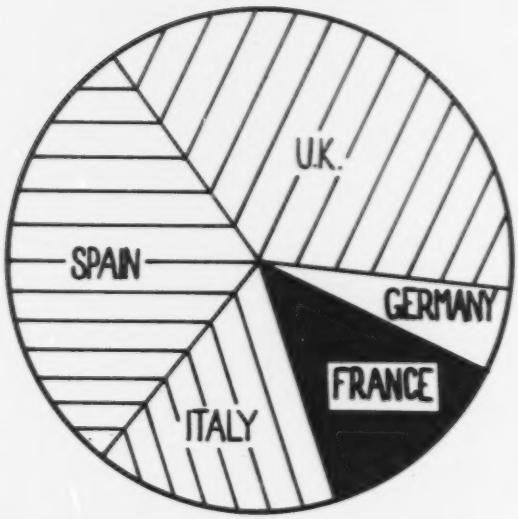
We'll look first at what are called pie-charts.

Let's start with a case:

Janet is the supervisor in a branch of a Travel Agency in a busy town centre. She has just finished counting up some figures on sales of holidays for the last three months (January - March). She now wants to use the data in two different ways. Firstly, the manager has just asked for an analysis of holiday sales by country for the last three months, which he wants to compare with other branches. Secondly, she wants to give some feedback to the staff on how well the various holidays are selling and how much income this is bringing into the branch. She has prepared a number of tables and digarams which she thinks will help make the figures easier to understand.

Here is a diagram she has drawn to show how holidays are distributed between countries.

HOLIDAYS SOLD - JANUARY TO MARCH
COUNTRY VISITED



Diagrams like this are called PIE-CHARTS they actually look like a pie which has been cut into different sized pieces.

ACTIVITY 2
Time guide
15 mins

Look carefully at the pie-chart and answer the following questions.

(1) Respond to each statement by writing TRUE or FALSE in the space provided.

(a) The country to which most holidays have been sold is Spain.

_____

(b) The country to which least holidays have been sold is Germany.

_____

(c) About one third of holidays are to the UK.

_____

(2) Write down two advantages and two disadvantages of pie-charts.

Advantages * _____

* _____

Disadvantages * _____

* _____

(1) (a) true The largest area marked in the circle is for Spain. However there is very little difference between Spain and UK so you may well have thought they were much the same. (b) true Germany has the smallest area in the circle. (c) true The area for the UK is about one third of the circle.

(2) The advantages and disadvantages you have written down may be included in the following:

Advantages:

* Easy to understand;
* It makes a strong impact, or it catches the eye;
* It makes comparisons easy.

Disadvantages:

* We can't clearly distinguish differences eg between Spain and the UK;
* It doesn't tell us the actual number of holidays sold to the various destinations;
* It can be confusing if there are a large number of countries.

So pie charts are very useful for SHOWING HOW THE TOTAL IS DIVIDED. You will have noticed that each piece of pie shows the size of the item it represents. So in the example above if one quarter of the sales had been to a particular country then one quarter of the circle would be allocated to the country. Pie charts are popular because of the strong impact they have, and because they are easy to understand. They show up differences very well.

There is an example of a PIE CHART in the following activity; you will see its usefulness.

ACTIVITY 3
Time guide
2 mins

SALES INCOME

This pie-chart is typical of the type which might appear in a company report to employees showing the proportion of income which goes to labour, the proportion to profit and the proportion to other costs.

1 Would the pie chart be appropriate for Janet to use as feedback to her staff?

YES/NO * _____

Give one reason for your answer.

* _____

_____

2 Would the same pie chart be useful to convey sales figures to her manager?

YES/NO * _____

Give one reason for your answer.

* _____

_____

The answer to this question is a matter of opinion but here's how I would respond:

(1) The feedback to staff is of a general nature, letting them know in which areas the branch is doing well and therefore a pie chart would be quite a good way to catch their interest.

(2) The manager, on the other hand, wants to compare results with other branches, therefore he needs to know detailed figures which a pie chart would not give him. It would not therefore be a suitable means of communicating the data to him.

Let's turn to some other pie charts.

Sometimes greater clarity is achieved by writing in the percentages in each division, giving the chart above as

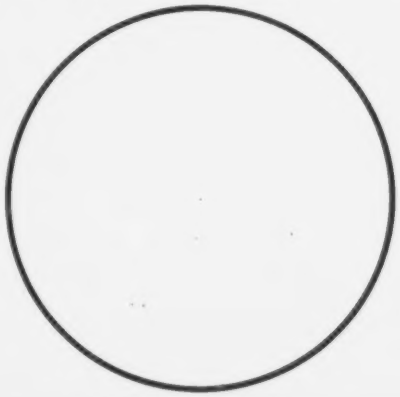
SALES INCOME

What the diagram tells us it that 37 per cent of income goes to wages, 8 per cent to profit and 55 per cent to other costs. Percentages are in fact measures of one hundredth so 8 per cent is eight hundredths. An easy way to picture this is 8p in the £. So for every £1 of sales income, 8p goes to profit, 37p to labour costs and 55p to other costs.

ACTIVITY 4
Time guide
2 mins

In a ballot to decide to which charity to give some money, votes were cast as follows:
One half to A, a local children's home
One quarter to B, an international children's charity
One quarter to C, a national charity to help the elderly

Draw a pie chart of this data:



Your pie chart might look something like this:

BALLOT RESULTS

It does not matter where in the circle the divisions occur provided the "pieces of pie" - segments - are the correct size. For example,

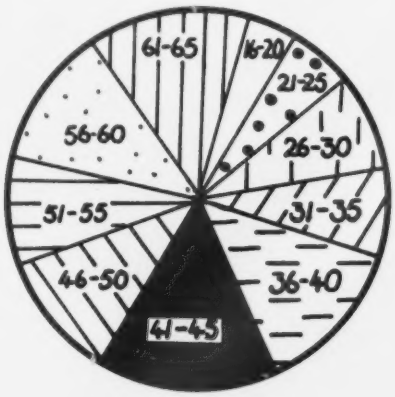
are equally correct.

7

Let's take another look at pie charts.

ACTIVITY 5
Time guide
2 mins

Look at this pie-chart for a moment:



Do you think this is a useful diagram? _____

Why _____

_____

Because of the large number of groups it is almost impossible to distinguish between them. Also the large number of categories reduces the impact the diagram can make. So it's not very useful.

You will have probably noticed something else. Unlike the other pie charts this one had NO HEADING OR TITLE. A diagram that is not clearly labelled is of little value no matter how good it looks.

Let's have a quick review of the value of pie-charts.

WE WOULD USE A PIE CHART WHEN

* we want to make an impact
* the detail of the figures was not important
* we want to draw attention to broad divisions in data.

WE WOULD NOT USE A PIE CHART WHEN

* we have a large number of divisions or groups
* we want to draw attention to small differences between groups.

WE SHOULD ALWAYS REMEMBER TO LABEL OUR DIAGRAMS

SELF CHECK 1
Time guide
3 mins

Respond to each statement by writing TRUE or FALSE in the space provided.

(1) Pie charts can be used to identify small differences in data

* _____

(2) Pie charts give a clear indication of how a total has been shared between different groups or categories.

* _____

(3) Pie charts can be used to identify exact numbers in a category.

* _____

(4) Pie charts are used to make a visual impact.

* _____

The answer to this self check is here in the following words. So you'll need to check your answers carefully. (1) false Only fairly large differences can be distinguished on a pie chart. (2) true They are good at showing how the 'pie' or total is shared. (3) false They are not accurate enough to identify exact numbers. However these are sometimes written into the chart. (4) true The main reasons for using the pie chart is to 'catch the eye'.

2.2 Pictograms

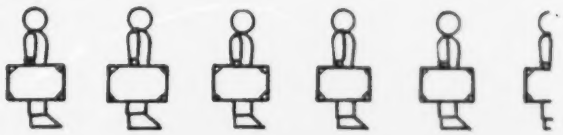
Another popular way of catching the eye is with the use of PICTOGRAMS. In these a picture is used as a symbol to indicate amounts of whatever is being measured. For instance with the data in our holiday case we could use one person with a suitcase to represent the sale of 50 holidays. If the numbers of holidays sold for the various destinations were

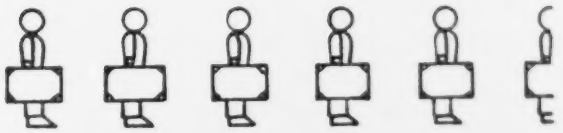
UK	265	ITALY	120
SPAIN	280	GERMANY	40
FRANCE	80		

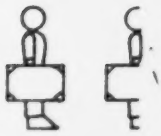
then a pictogram could appear as below:

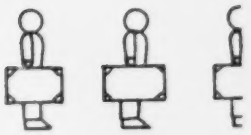
NUMBER OF HOLIDAYS SOLD

DESTINATION

UK 

SPAIN 

FRANCE 

ITALY 

GERMANY

KEY:

= 50 holidays

The key tells us what the symbol of picture represents.

We have already mentioned how important labeling a diagram is. In this case we must notice the importance of a key:

WITHOUT THE KEY TO THE SYMBOL WE CANNOT UNDERSTAND THE DIAGRAM.

ACTIVITY 6
Time guide
2 mins

Jot down ONE advantage and ONE disadvantage you can think of for this type of diagram.

Advantage * _____

Disadvantage * _____

_____

10

Typical responses could be:

Advantages -

* They have a strong visual impact (or catch the eye);

* They are easy to understand.

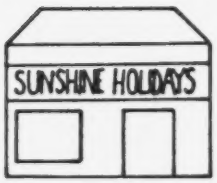
Disadvantages -

* They are inaccurate - for example it is difficult to show 40 holidays if one picture equals 50 holidays;

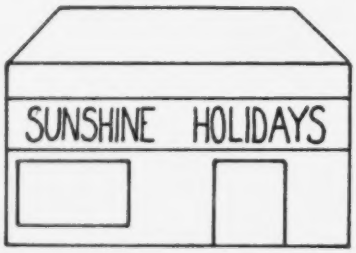
* They are difficult to produce - someone has to prepare the drawings.

Another type of pictogram which is often used shows different sizes. So for instance if we wanted to compare sales of holidays at two different branches of travel agents then two different size pictures of the shop might be used. For example

HOLIDAYS SOLD AT NEWTOWN



HOLIDAYS SOLD AT SEAPORT



ACTIVITY 7
Time guide
1 mins

Note down one conclusions you could draw from this diagram.

* _____

We can safely conclude from this diagram that sales are higher at Seaport than Newtown. It would be difficult to say whether they were twice as high, four times as high or even more.

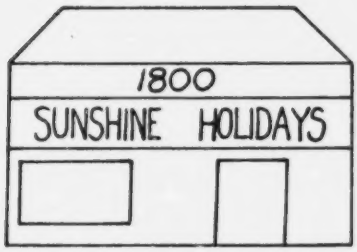
The basic difficulty is that

WE DO NOT HAVE ANY SCALE OF MEASUREMENT

We do not know whether the difference in sales is related to the height of the buildings, the area of the buildings, or even the volume of the buildings. Because of this, when this type of diagram is used, it usually has the corresponding figures included. For example

NUMBER OF HOLIDAYS
SOLD AT NEWTOWN

NUMBER OF HOLIDAYS
SOLD AT SEAPORT



The drawing is then only being used as a means to get people to look at the figures: we can now see that 650 holidays have been sold at Newtown and 1800 at Seaport.

THE DIAGRAM VISUALLY EMPHASISES THE DIFFERENCE

The main purpose of a pictogram is to catch the attention of those who would not otherwise look at a set of figures which we want to draw to their attention.

REFERENCE 1
Page 60

Pictograms are often used in magazines and newspapers, because they catch the attention. As Allan Hall says, for the public it's "necessary to select a presentation with the greatest impact".

The best method to use is a key with one picture equal to a fixed amount of what is being measured. There are two problems in this:

* Pictures are difficult to draw

* It is difficult to accurately draw part of a picture

* Preparation takes time

Differences between two totals are sometimes shown by different sized diagrams. These cannot usually be drawn accurately, and are only used to emphasize the differences. These are only useful if the figures are also included. We would not use either type of diagram for those who are used to dealing with figures, or who have a strong interest in the details.

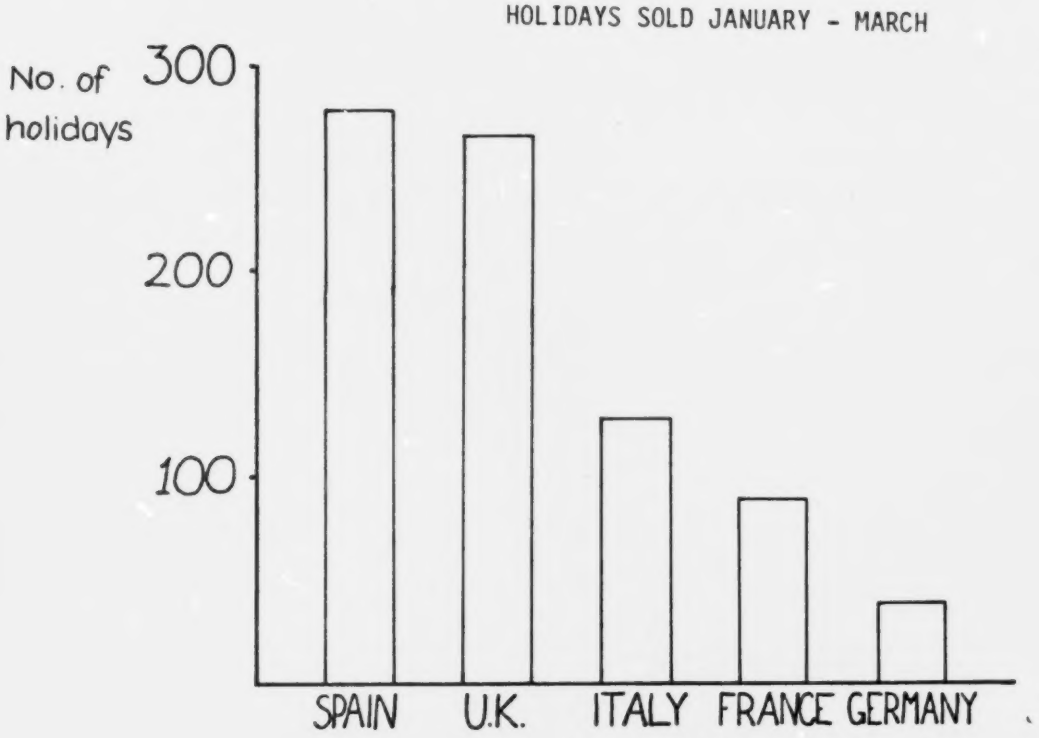
There are other ways of looking at data which combine visual inpact with greater accuracy. One of these is a bar chart.

2.3 Bar Charts

Let's return to our case incident. In addition to the pie chart Janet had also drawn up a bar chart for the number of holidays.

WITH A BAR CHART THE LENGTH OF THE BAR
SHOWS THE NUMBER OF ITEMS IN A CATEGORY

This is the bar chart Janet had drawn.



Note how the chart has been drawn. There is a SCALE on the left-hand side of the chart which measures numbers of holidays sold. You will see the scale goes up to 300. For each country of destination a bar has been drawn up to a level which measures the number of holidays sold. For instance we can see that the number of holidays sold for Spain is just below 300, about 280. The number for the UK is slightly less, about 260 - 270.

ACTIVITY 8
Time guide
2 mins

Approximately how many holidays were sold for

Italy _____

France _____

Germany _____

It's unlikely that we'll agree precisely as we have both had to estimate the figures: Italy 120; France 80; Germany 40.

One of the things we are always trying to do with a diagram is 'make an impact' or 'catch the eye'. With bar charts the impact can be increased by the use of colour. The bar chart could be coloured in one colour throughout or different colours for each country.

ACTIVITY 9
Time guide
3 mins

Compare the bar chart with the pie chart we looked at earlier.

(1)
What information can you obtain by looking at the bar chart?

* _____

_____

What information can you obtain by looking at the pie chart?

* _____

_____

(2)
In the holiday case would the bar chart be an appropriate way to present the data to

(a) the manager _____

(b) Janet's staff _____

(1) By looking at:

* the bar chart we can see HOW MANY holidays have been sold to each country. We can see clearly the DIFFERENCE BETWEEN NUMBERS of holidays sold to each country.

* pie chart we see THE SHARE of total sales of holidays to each country.

(2) It is a matter of opinion as to whether this chart should be used to present data to the manager or the staff. It is a very versatile chart and you may well feel Janet would like to use it to put across to the manager how high sales have been in the various categories. He would probably also require more detailed information and we will look next at how this could be presented. Also the chart has a good visual impact and she could use it to present data to the staff, although it it likely they would have more interest in the pie chart which shows the SHARE of sales for each country. So on balance the bar chart seems useful to both manager and staff.

Let's now move on to look at how Janet could present the detailed figures to the manager.

2.4 Tables

In order to compare the Branch Sales with other branches the manager would almost certainly need to see the detailed figures.

WHEN PREPARING DETAILED FIGURES IT IS IMPORTANT TO LAY THEM OUT IN A WAY WHICH MAKES THEM CLEAR AND EASY TO READ

The table Janet prepared is given below. Notice how it has been drawn up:

* headings clearly identified
* column lines to separate the figures
* boxed-in to make the table stand out

There are many styles in which a table can be drawn up, but the important point to remember is the clarity of the overall picture presented.

HOLIDAY SALES JANUARY - MARCH

COUNTRY	NUMBER OF HOLIDAYS	VALUE OF SALES £
UK	265	50,400
SPAIN	280	53,000
FRANCE	80	28,000
ITALY	120	30,000
GERMANY	40	12,000
TOTALS	785	173,400

ACTIVITY 10
Time guide
2 mins

What one piece of information would the manager be able to get from this table which he would not be able to get from any of the diagrams we have looked at so far?

*

There's a number of things that the table shows:

* The table gives the exact number of holidays booked for each destination;

* The sales volume in money has been included on the table;

* The table gives the total number of holidays and total sales value. Why not add some of these items to your list above for easy reference. Tables therefore are useful, even essential, for looking at detailed figures. What they lack is the impact, and instant conveying of information that a picture can give.

A pie chart, bar chart or pictogram will instantly convey some information but:

A TABLE HAS TO BE CAREFULLY EXAMINED TO GIVE INFORMATION.

There are other ways of drawing up tables, which help us to find out more about a set of figures.

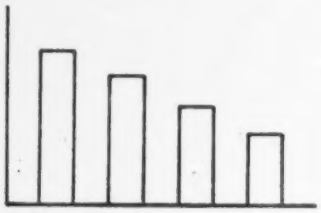
EXTENSION 2
Page 59

For example the manager in our example might want to use our table to find things like "averages", which will give a more detailed picture. We're not going to look at special ways of drawing up tables in this unit, but you might like to take up our extension to another Choice unit which does.

SELF CHECK 2
Time guide
3 mins

Respond by completing each sentence with a suitable word or words.

1



This diagram is a _____

2

This diagram is a _____

3 When detailed figures are required we should present them in a _____.

4 A _____ is a good diagram for showing how a total is broadly shared between groups or categories

5 All diagrams should have a good visual _____

6 Diagrams are used to make figures _____

The answers to this self check is here in the following words, so you'll need to check out your answers carefully. 1) bar chart; 2) pie chart; 3) table - none of the diagrams we have looked at gives detailed figures; 4) pie chart; 5) impact; 6) clear - easier to understand

3 Summary

* Our four methods of presenting data were:

  PIE CHARTS PICTOGRAMS

  BAR CHARTS TABLES

* We said we must always remember to label our diagrams.

* PIE CHARTS:

  ARE GOOD for

  * giving visual impact to data

  ARE NOT SO GOOD when

  * smaller detail is important

* PICTOGRAMS:

  * good because they are "eye catching" but
  * are difficult to draw

* BAR CHARTS:

  * can be shown against a scale

* TABLES

  * can convey detailed data
  * but "reading" tables quickly can be difficult

PART B COMPARING DATA

1 Introduction

Obviously drawing up various diagrams and tables to show or summarise data is very useful. We can extend this usefulness if we were able to show changes that might have occurred between one week and the next. In our earlier example of foreign holidays, it would be helpful to know for instance whether people have switched from Italian to Spanish holidays.We can then explore the reason for this.

2 Comparison methods

So let's see how we can make comparisons with our data presentation methods, and where these don't work too well introduce one or two others which will help.

2.1 Comparing with Pie Charts

The following case shows how some of the diagrams can be used for making comparisons.

Case

The management of Briggs Ltd., a medium sized engineering Co. are concerned about an increase in accident rates over the last year. Where possible they have taken steps to improve safety but they also want to stress to their employees that accidents have increased, despite the fact that there has been no change in working practice. In particular, they want to encourage a more responsible attitude to safety and they are asking for suggestions of ways to make the environment and make work practices safer.

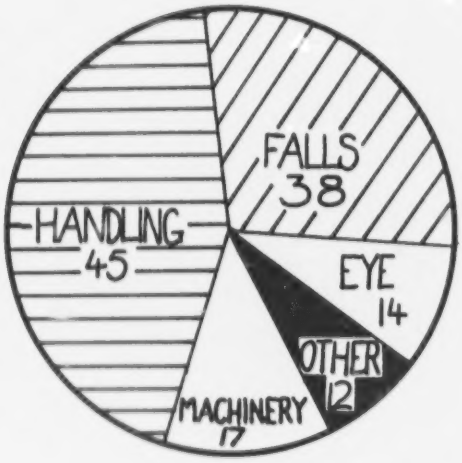
They have therefore prepared some information for the supervisors to circulate to operatives, and are in the process of deciding which of two diagrams to use. The first uses pie-charts and the second uses bar-charts.

If you look at the pie charts you'll see that the 'pie' for this year is larger than last year's because the total number of accidents has gone up.

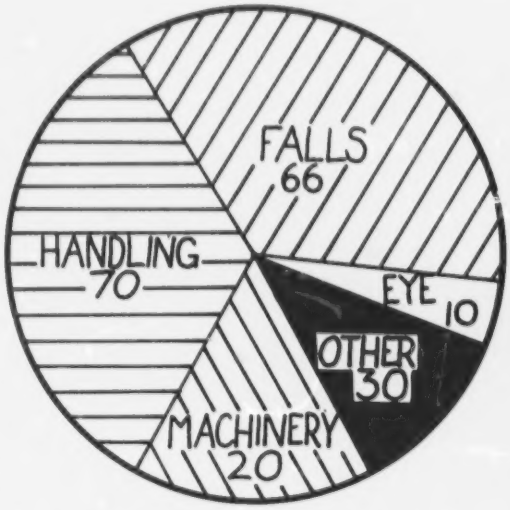
ACTIVITY 11
Time guide
2 mins

BRIGGS LTD. - ACCIDENTS AT WORK

LAST YEAR



THIS YEAR



From the diagrams above, what can two comparisons can you make about changes in accident rates in the two years at Briggs Ltd.

* _____

* _____

We can at least see these following from our comparison:

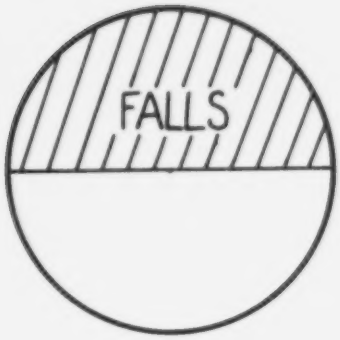
- Accidents due to falls have increased (the area allocated to falls is a larger share of a larger total)
- The proportion of accidents which are eye injuries has gone down
- The proportion of accidents due to machinery has increased
- The proportion of 'other' accidents has increased

Notice particularly when making comparisons with this type of diagram, that when there is a larger share of a larger total, we can conclude that the actual number of accidents has increased. In this case we can therefore conclude that accidents due to falls have increased. But did you have any difficulty making a comparison between this year's and last year's accident rate resulting from handling?

WHERE THERE IS A SMALLER SHARE OF A LARGER TOTAL WE DO NOT KNOW FROM THE DIAGRAM WHETHER THE NUMBER OF ACCIDENTS HAS GONE UP OR DOWN

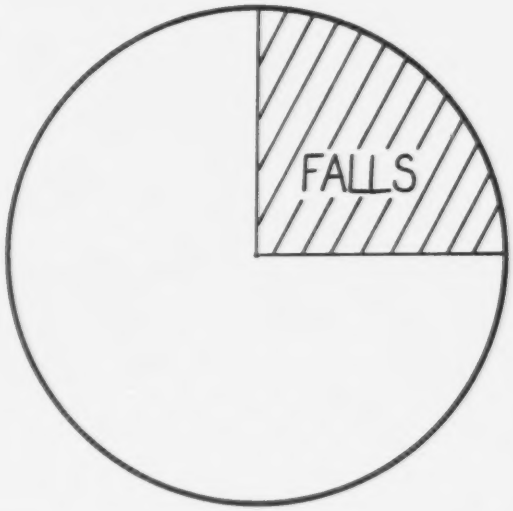
For example, suppose there are 6 accidents in one months, half of which are due to falls. If in the next month there are 12 accidents of which one quarter are due to falls, then the number of falls is exactly the same (three in each case) but this would show on a pie-chart as a smaller proportion of a larger circle.

FIRST MONTH



3 OUT OF 6

SECOND MONTH



3 OUT OF 12

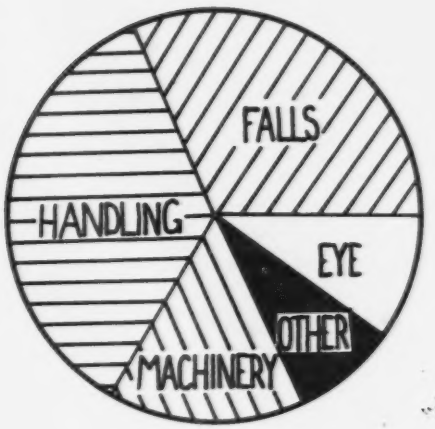
In each diagram the number of accidents due to falls is the same, and in fact the shaded area is the same, however it is not easy to see this simply by looking at the diagrams.

The main difficulty in using pie charts in this way, that is changing the size to make comparisons, is that it is very difficult to know how much larger one circle is than the other

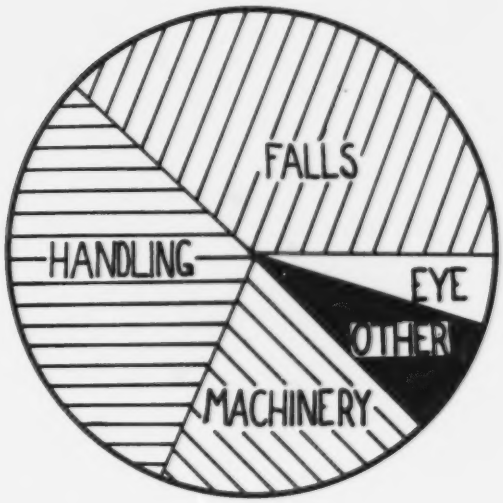
The pie-charts can be made more accurate by writing in the figures and using the diagram as a means to draw attention to them. In this way our previous pie-chart would appear like this:

BRIGGS & CO - ACCIDENTS AT WORK

LAST YEAR



THIS YEAR



FIGURES INDICATE NUMBER OF ACCIDENTS

We can probably see that:

The main ADVANTAGES of using pie-charts for comparison are:

- for visual impact
- to show a large increase or decrease in the total
- to show fairly large changes in the share of the total going to different categories

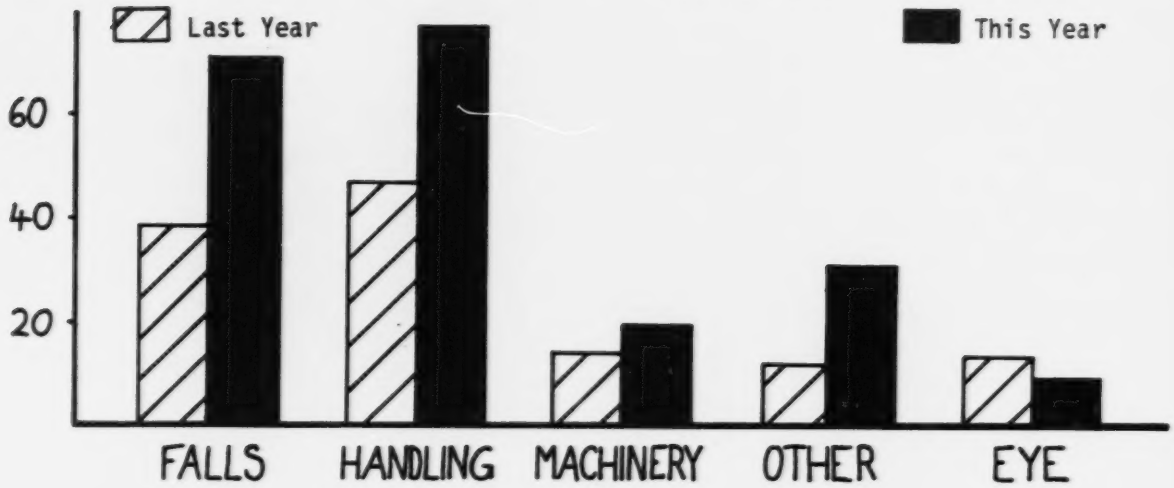
The main DISADVANTAGES of using pie charts for comparison are:

- they do not tell us the exact amount of change
- the difference in size can be unclear and confusing

2.2 Comparing with Bar Charts

Let's now look at the alternative diagram that Brigg's management is considering.

BRIGGS LTD. - ACCIDENTS AT WORK



ACTIVITY 12
Time Guide
2 mins

Make a note of two conclusions you could draw from this diagram about changes in accident rates which could not be drawn from the first pie-chart.

* _____

* _____

The conclusions abe to be drawn are:

* the number of accidents in each category;

* that the number of eye injuries has fallen;

* the amount of the increases in each of the other types of accidents.

So a bar chart, like a pie chart, gives data a good visual impact. But bar charts are better than pie charts in two ways:

BAR CHARTS PRESENT DATA MORE ACCURATELY AND MAKE COMPARISONS EASIER TO DRAW

ACTIVITY 13
Time guide
1 min

Note down one feature which the pie chart emphasises but the bar chart does not:

* _____

Two features come to mind:

* The pie-chart draws particular attention to the fact that THE TOTAL HAS INCREASED. Although we could work this out from the bar chart, this is not the main message that comes across.

* The bar-chart draws attention to the DIFFERENT CATEGORIES and the changes in those categories.

* The pie chart also shows us the SHARE of each category in the total number of accidents.

Briggs Ltd. have 3 sorts of diagrams to chose from:

* Pie-chart

* Pie-chart with numbers of accidents printed in

* Bar-chart

They must choose which to use. They do know however:

* The pie-charts emphasize the overall increase, although this is not measured accurately.

* Pie charts show how the different categories have changed in fairly broad terms, and the figures can be included to give greater accuracy.

* The bar-chart draws attention to the increases in particular categories, and it is easy to measure how much each category has increased.

Let's move on to see what might guide their choice.

2.3 Choosing between Pie Charts and Bar Charts

This is a matter of judgement - there is no certain way of deciding. Try your judgement on the following:

ACTIVITY 14
Time guide
6 mins

Bearing in mind that the purpose for which the diagrams are to be used is to draw the attention of employees to the increase in accidents and to encourage them to take greater care in future which diagram would you choose?

Pie-chart (without figures)

Pie-chart (with figures)

Bar-chart

* _____

Give the main reason for your choice

* _____

There is no 'correct' answer to this question. All the diagrams make a good impact and convey the necessary information. However the best is probably the pie-chart with the numbers included because:

* It draws particular attention to the main point that management want convey - to that accidents have increased;

* The inclusion of actual figures means direct comparisons can be made between figures for the two years withou having to refer to a scale at the side of the diagram.

SELF CHECK 3
Time guide
2 mins

Respond to each statement by writing TRUE or FALSE in the space provided.

1 In comparing two sets of data, pie charts are useful for showing up any category taking a larger or smaller share of the total. * _____

2 Pie charts can be used to convey the amount of change from one period to the next. * _____

3 Bar charts can be used to show a larger proportion of the total going to a particular category. * _____

4 Bar charts are a good way of showing the actual change of categories from one period to the next. * _____

The answers to this self check are here in the following words, so you'll need to check out your answers carefully. 1) True The share which is taken by each category is shown by the area of the circle allocated; 2) False Pie charts only show proportional changes. The amount is only known if it is written into the pie chart; 3) False A bar chart can show changes in actual amounts. It does not show the proportion of the total in different categories, although this could be calculated from the information in the bar chart; 4) True This is exactly what bar charts are used for.

3 Detailed Bar Charts

Bar charts come in all shapes and sizes. They can be simple or complex according to the information or data we want to show. Let's explore some of these more detailed Bar Charts, they will help us when we want to make comparisons.

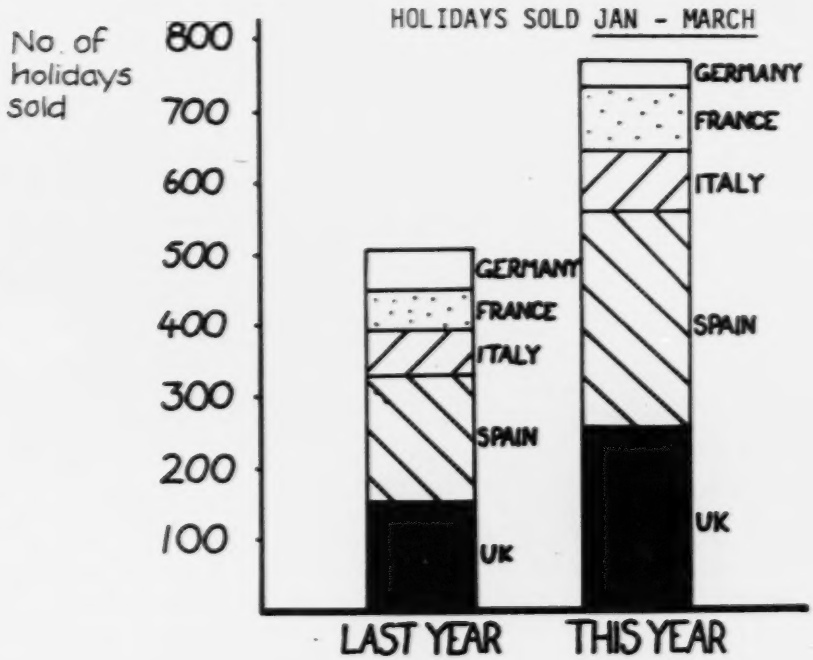
REFERENCE 2
Page 60

As Peter Clark points out, some of these are very useful because aswell as allowing us to compare two different things, eg sales of beer and sales of larger. They also allow us to compare different sets of figures about the same thing. eg sales of beer over the past 3 years.

3.1 Component Bar Chart

We'll introduce ourselves to this form through an example:

Janet, the supervisor for the travel agent in our first case has now collected some further information that the manager has requested. After receiving this information on current year's sales, he asked her to get out the files with last year's figures and compare the two. He wants to use the information in some publicity material he is preparing which will emphasise the increase in holidays to Spain and in the UK. He has therefore asked her to put the information into a suitable diagram. Janet decided to try the following COMPONENT BAR CHART.



Before considering how effective the diagram is let's look at how the diagram has been drawn. There is a scale up the left hand side showing the number of holidays sold. THE TOTAL LENGTH OF THE BAR SHOWS THE TOTAL NUMBER OF HOLIDAYS SOLD. Thus we can see that 780 holidays sold this year results in a bar which stops just short of the 800 mark on the scale at the left hand side.

ACTIVITY 15
Time guide
5 mins

1 Approximately how many holidays were sold last year

a in total * _____

b to Spain * _____

c in UK * _____

2 Appoximately how many holidays were sold this year

a in total * _____

b to Spain * _____

c in UK * _____

Let's look at the answers in detail. Don't worry if we are between 10 and 20 different.

1a) Last year the total was about 500;
1b) About 200 holidays were in Spain;
1c) About 130 holidays in the UK;
2a) This year the total was around 780;
2b) About 300 holidays were in Spain;
2c) 260 holidays were in the UK.

The biggest problem is getting accurate figures for Spain. As the Spanish holiday figures do not start at the botton of the bar we must take off any holiday figures below them. The Spanish figures do not finish at the top either so we must take those holidays away as well. This is a big disadvantage to this sort of bar chart.

On the other hand, it is easier to see how much the total has increased or decreased when compared with a pie chart.

ACTIVITY 16
Time guide
2 mins

Would this diagram be suitable for the manager's purpose case, to prepare publicity material showing the increases in holidays to Spain and the UK.

Yes/No * _____

Give the main reason for your answer.

* _____

_____

The answer is a matter of personal judgement. However, the diagram shows quite well the increase of holidays to Spain and the UK. It shows not only that holidays to these areas have increased, but approximately how high the increase is. It would therefore be quite appropriate for use as publicity material. However it would, once again, not be suitable if detailed figures were required.

A component bar chart can, therefore, be used to show a change in the total and a change in the 'component parts' of that total, ie the subdivisions. It is useful to show the approximate size of the changes, and it shows quite clearly which categories have increased or decreased. Its main disadvantage is that it is sometimes difficult to read off the size of the categories within the bar, from the scale at the side.

3.2 Two-directional Bar Charts

Another way of using bar charts is to measure increases and decreases in opposite directions. This is useful if we want to emphasise which areas are improving and which are going back. Let's look at another case.

Case

Joe Sanderson is responsible for a small team of salesmen selling household cleaning products. He has compiled some figures comparing this year's sales with last year for his area and a neighbouring area (covered by another sales team). Although his team have done well in some products he wants to draw their attention to products where they have done less well and where there appears to be potential sales. In particular, the firm's cream cleanser has been improved in the current year and he does not feel sufficient sales effort has gone in to promoting this product.

The following table shows sales for the two areas in the last two years.

SALES OF HOUSEHOLD CLEANSING PRODUCTS in £1,000's

	AREA 1 - Joe's area			AREA 2		
PRODUCT	Last year	This year	Difference	Last year	This year	Difference
BLEACH	40	55	* +15	35	40	* +5
WASHING POWDER	140	150	*	120	130	*
WASHING-UP LIQUID	80	85	*	80	70	*
CREAM CLEANSER	50	45	*	40	75	*
WINDOW CLEANER	20	25	*	15	25	*

ACTIVITY 17
Time guide
2 mins

Joe's area is Area 1 and Area 2 is the neighbouring district. The right hand column is to show the difference between last year's sales and this year's sales. I have filled in the first figures in each column. Complete the table showing a + sign where sales have increased and a - sign if sales have gone down.

Check your table to this one:

SALES OF HOUSEHOLD CLEANSING PRODUCTS £000s

PRODUCT	AREA 1			AREA 2		
	Last year	This year	Difference	Last year	This year	Difference
BLEACH	40	55	+15	35	40	+ 5
WASHING POWDER	140	150	+10	120	130	+10
WASHING-UP LIQUID	80	85	+ 5	80	70	-10
CREAM CLEANSER	50	45	- 5	40	75	+35
WINDOW CLEANER	20	25	+ 5	15	25	+10
	330	360	+30	290	340	+50

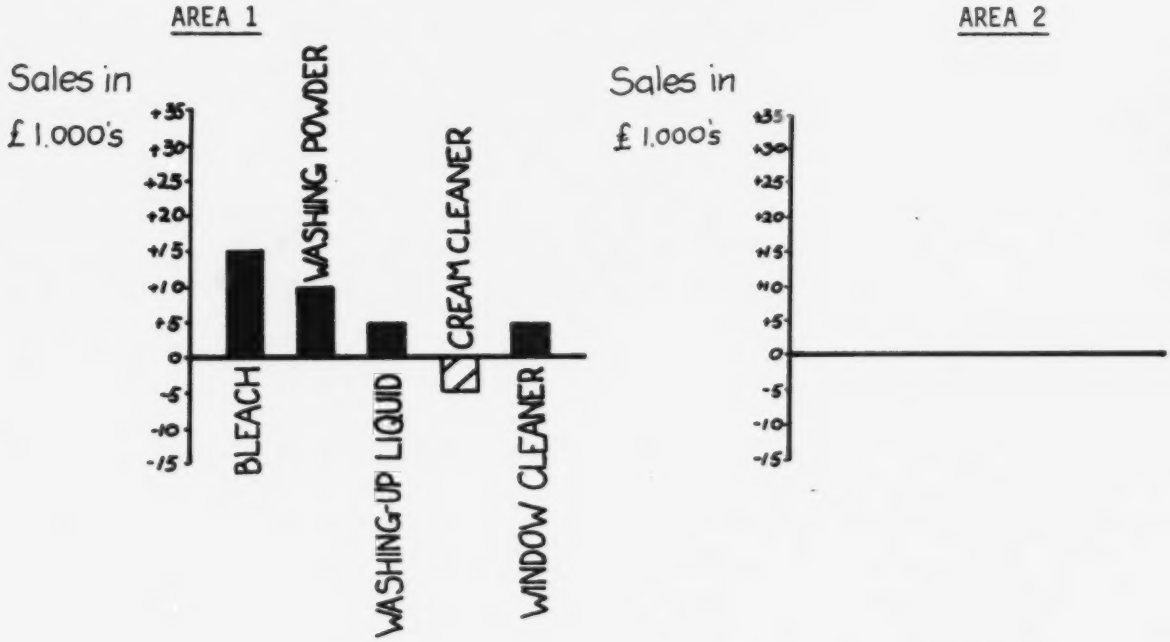
The main point that Joe wants to make using this data is the increase in cream cleanser sales in Area 2. He decides to use a two directional bar chart to do this.

To draw a two-directional bar chart we first draw in a line to represent zero and then put the increases above the line and the decreases or negative below the line. In this case Joe requires two charts, one for each sales area.

ACTIVITY 18
Time guide
4 mins

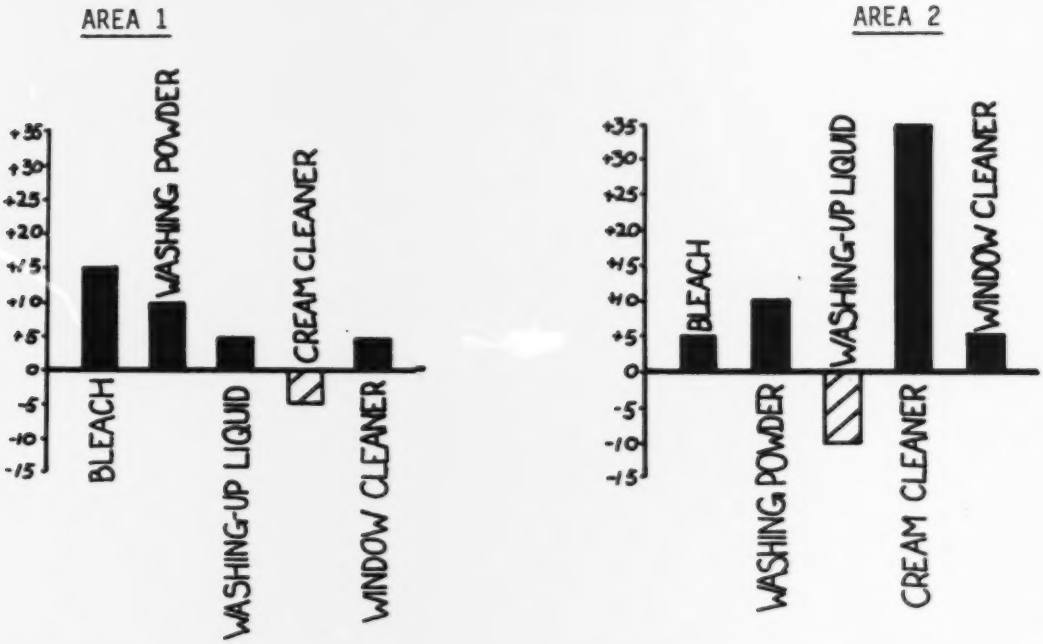
I have drawn the chart below for the first area. Complete the chart for the second area in the same way. Notice the horizontal line marks the zero position or 'no change'. Increases are shown above the line, and decreases below the line. Notice I have shaded the bars above the line differently to those below the line. If you have a red pen, use that to show the decreases even more clearly. Don't worry about drawing the bars absolutely accurately, just draw them up against the scale as close as you can judge.

SALES - CHANGES FROM LAST YEAR



Here's the completed Two-Directional Bar Charts:

SALES - CHANGES FROM LAST YEAR



ACTIVITY 19
Time guide
2 mins

Now look at the two diagrams and note down two other main features which stand out:

* _____

* _____

The main features are:
* Sales of most products have increased;

* Sales of cream cleanser are down in area one and up dramatically in area two;

* Sales of washing-up liquid are down in area two but up in area one.

A two-directional bar chart is a very good tool to use if you want to draw attention to changes, both upwards and downwards, from previous figures.

However they are not suitable if we need to show the actual amounts eg total value of sales.

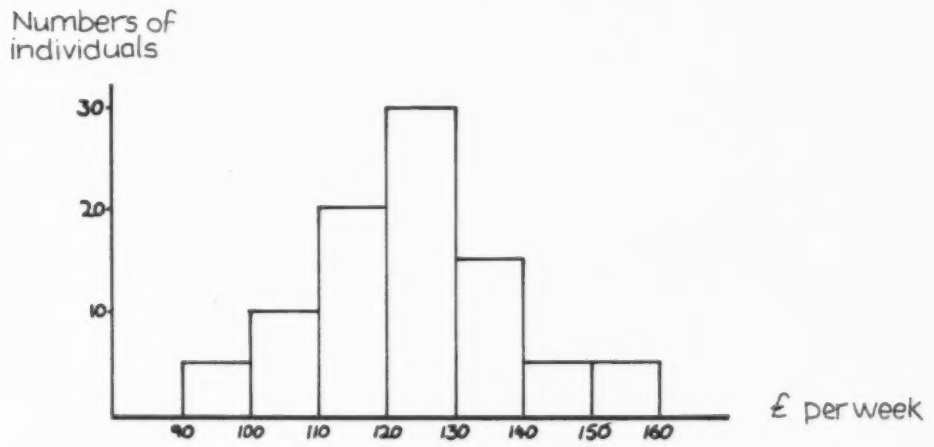
3.3 Histograms

A histogram is a diagram which looks very much like a bar-chart, but is really quite different. Let's explore these differences.

Case

Suppose we collected data on earnings in a particular week for 90 employees. Beacuse of different wage rates, overtime, bonuses and so on, each individual could have different earnings: the data we collected could be displayed in the following type of diagram:

Weekly earnings - 9 - 16 September



ACTIVITY 20
Time guide 2 mins

This diagram differs from the first type of bar-chart we looked at earlier in the case about holidays. Note down the two differences:

* _____

* _____

There are 2 basic differences

* There are no spaces between the bars;

* The bars do not have individual labels or descriptions on them.

In a bar chart, we're interested in the height of our bars. The area of the bars doesn't matter. With a histogram the area of the bar is important.

The beers on our bar charts each showed seperate things - sales of bleach, sales of washing up powder.

Histogram bars all show the same thing. In our example, each bar relates to earnings. There is a scale along the botton of our histogram showing us the range of earnings from the lowest to the highest.

So, the bars form a continuous measurement of the same thing - weekly earnings. they don't show separate things like washing powder and bleach.

A histogram can be read in the same way as a bar-chart. The length of the first bar indicates the number of individuals earning between £90 and £100 per week. Since it is important that we know which group an individual earning exactly £100 goes in to we would describe the bottom grouping as £90 to £99.99. Similarly the second group would be £100 to £109.99. From the diagram, there are 5 individuals earning between £90 and £90.99 a week and 10 earning between £100 and £109.99.

ACTIVITY 21
Time guide
4 mins

Using this same histogram of weekly earnings, approximately how many people are there in the following groups:

£110 - £120 * _____

£120 - £130 * _____

£130 - £140 * _____

£140 - £150 * _____

£150 - £160 * _____

Because we are both reading off a scale which isn't meant to be too precise, our figures might be a little different:

£110 - £120 = 20;
£120 - £130 = 30;
£130 - £140 = 15;
£140 - £150 = 5;
£150 - £160 = 5;

THE BASIC DIFFERENCE BETWEEN HISTOGRAMS AND BAR-CHARTS IS THAT HISTOGRAMS HAVE A CONTINUOUS SCALE ALONG THE BOTTOM LINE OR AXIS

This is the reason why there are no spaces between the bars. So for a histogram the top end of one category always merges with the bottom end of the next category. Bar-charts are used where the categories are identified by a description rather than a minimum and maximum value.

With a bar-chart, spaces between the bars often help to make a better visual impact. A histogram, however, will only have spaces between the bars, if there is no entry in the bar eg if, in our example in Activity 22 no-one earned between £120 to £130 then there would be a space.

Let's go on now to look at one of the most common charts in use in organisations, graphs.

4 Graphs

Graphs are used in almost all organisations when we wish to record and display data which is recorded over time

EXTENSION 3
Page 59

GRAPHS ALLOW US TO LOOK AT THE PATTERN DATA AND IDENTIFY CAHNGES OVER TIME

REFERENCE 4
Page 60

As Peter Clark points out "Statistical data may be processed in two basic ways, arithmetically or graphically - graphically methods can yield reasonably accurate results fairly quickly". So they are useful for busy supervisors who may not have the time to do more lengthy arithmetic processing.

To look at how graphs might be used, let's return again to the Travel Agent's case where Janet, the supervisor, was looking at sales figures.

Case

The manager of Sunshine Holidays Travel Agency Ltd was very pleased with the information Janet had been able to supply him with. Having studied the figures he would now like to look at the way in which the sales had built up over the three month period. He calls Janet into his office and asks her whether the sales built up in a similar way for each country. She explains that they didn't as most of the holidays to Spain are sold early in the year after which there is a sharp tailing off. Sales of UK holidays start later and tail off much more slowly. more slowly. He asks her then to prepare a graph to demonstrate this point.

Let's look in detail at how Janet could go about drawing this graph.

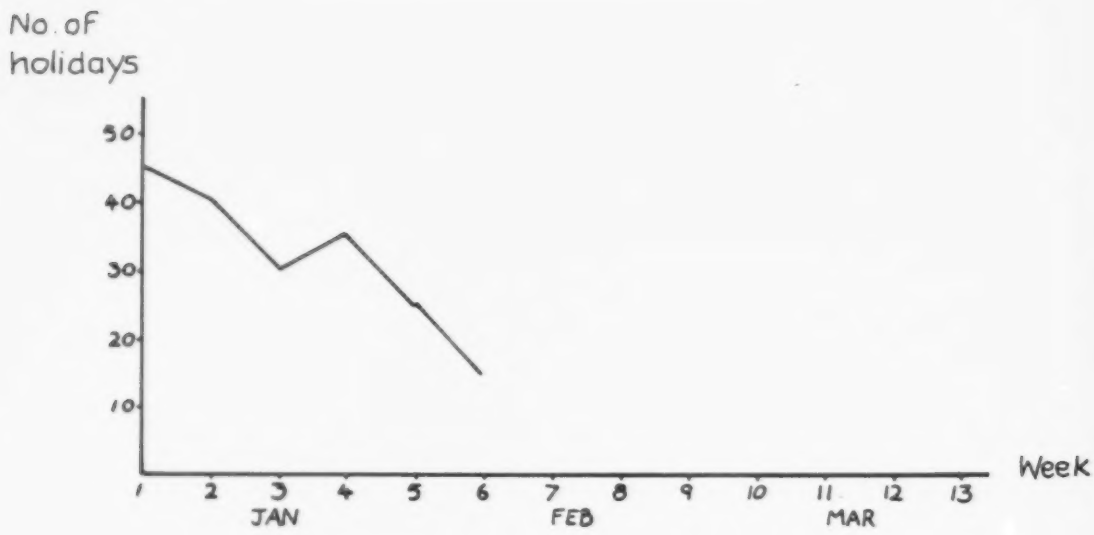
The data she had in sales of holidays to Spain over the three month period was as follows:

SALES OF HOLIDAYS TO SPAIN - JANUARY TO MARCH

	JANUARY				FEBRUARY				MARCH				
Week	1	2	3	4	5	6	7	8	9	10	11	12	13
Sales of Holidays	45	40	30	35	25	15	21	16	11	13	9	11	8

Below I have started a graph of sales for the 13 week period.

HOLIDAY SALES - JANUARY TO MARCH



Look first at how we set about drawing the graph. Notice, in the graph the weeks are numbered across the bottom of the graph and the number of holidays up the side. We chose a scale for the graph which allows the largest figures to be marked in. In this case the largest figure was 45 so we make the maximum a little above this at 50. Check this, and note the unit of measurement - 1 square equals 2 holiday sold. holidays sold. Across the bottom we use vertical lines for the weeks.

To mark the first point on the graph we look up sales for week 1 in the table, which gives a figure of 45. To mark this on the graph we go to the vertical line for week 1 and read up the left hand side until we find 45 and mark the point.

For week 2 the number of holidays is 40, so we go to the vertical line for week 2 and measure 40 up the side and make a second point. We then join the points with a STRAIGHT line.

ACTIVITY 22
Time guide
8 mins

1 Complete the graph I have started for weeks 7 to 13. Mark the points as closely as you can against the scales or axis.

2 Note down TWO advantages you think the graph has over a table of figures.

* _____

* _____

Here is the completed graph.

Typical advantages of a graph over a table are:

* It creates a good visual impact

* It immediately shows how sales have been moving

* It emphasises the downward movement of the sales data

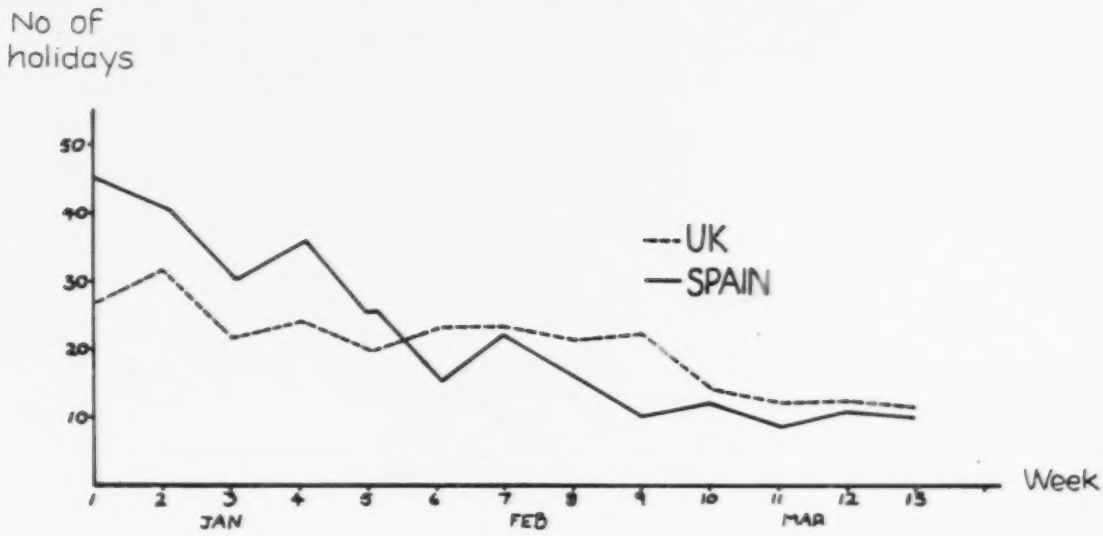
4.1 Comparisons using graphs

We now want to go on to compare the sales pattern for UK sales with that for Spain. We do this by drawing another line on the same graph. The figures for holiday sales in the UK for the same 13 weeks were as follows:

	JANUARY					FEBRUARY				MARCH			
Week	1	2	3	4	5	6	7	8	9	10	11	12	13
Sales of Holidays	27	31	22	24	20	24	23	21	23	15	13	12	10

If we plot these figures on the same graph we get the following:

HOLIDAY SALES - JANUARY TO MARCH



We need to put a label on each line so we can identify the countries.

ACTIVITY 23
Time guide
2 mins

What TWO features stand out on the graph now?

* _____

* _____

The two main features are:

* Holidays to Spain sell better in the early weeks of the period

* Sales of holidays in the UK are more evenly spread over the period but do start to tail off toward the end.

These points are, in fact, the points which Janet had made to the manager. The graph demonstrates them very clearly.

GRAPHS ARE SUITABLE FOR USE WHENEVER WE WANT TO DISPLAY CHANGING DATA OVER A PERIOD OF TIME

They are easy to understand and make a good visual impact, and so can be used for getting information to staff, to management or to the general public.

In our example the graph would give a clear picture to the manager of the way in which sales were building up. For this purpose the graph is MORE useful than detailed figures.

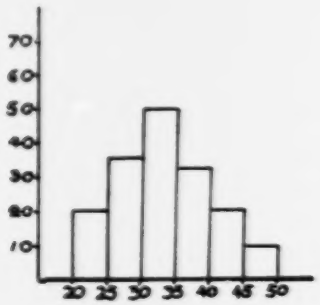
We'll finish our look at charts, tables and graphs with a self check:

SELF CHECK 4
Time guide
2 mins

Respond by completing each sentence with a suitable word or words.

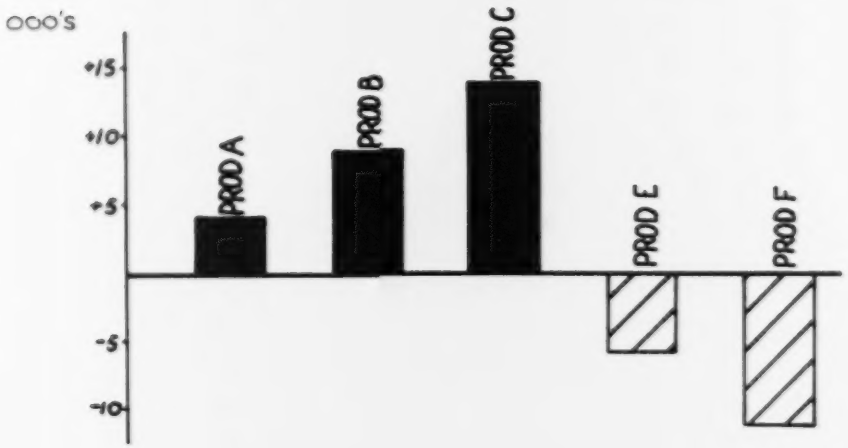
1 The following diagram is a _____

AGES OF EMPLOYEES



2 This diagram is a _____

CHANGES IN OUTPUT 1983 - 1984



3 Changes in data over a period of time can be shown on a _____

4 Histograms are for data which is on a _____ scale.

5 All diagrams are used to make a good _____.

The answer to this self check is here in the following words so you'll need to check carefully: 1) there's no spaces between the bars so this is a histogram; 2) the bars go above and below the line, so this is a two-directional bar chart; 3) we could use a bar chart, but we probably agree that a graph shows this best; 4) because there;s usually no spaces between lines on a histogram then the data exists on a continuous scale; 5) we use diagrams to give a clear visual impression. for questions 5 and 5 you could use other words with the same meaning.

5 Summary

* If we want to COMPARE data we need to CHOOSE our data presentation method carefully: e.g:-

  PIE CHARTS - we will only see the larger changes

  BAR CHARTS - smaller differences will be seen

* There is NO AGREED WAY OF CHOOSING between Pie charts and Bar charts when we wish to make comparisons - we just have to use our JUDGEMENT

* Our other two more complex Bar charts were:

  COMPONENT BAR CHARTS - which show changes WITHIN each "Bar"

  TWO DIRECTIONAL BAR CHARTS - useful to draw up ACTUAL CHANGES rather than the totals

* HISTOGRAMS - give data on a continuous scale and the areas of the bars matter

* GRAPHS - most useful to show developing changes over a period of time

PART C MEASURING DATA

1 Introduction

Up to here we have been looking at ways of presenting or showing data. We know that this is useful especially for making a visual impact. It is, as we admitted earlier, a way of showing data - but it doesn't really measure the data. So let's move on to see what we mean by measuring data.

Incidentally, if you have a calculator handy, then now is your chance to practice! You might even go out and buy one - it will save you some time in the rest of this unit. However you do not really need it for our examples, you'll manage quite well without it.

2 Summarising Data

When we come acros data it's usually just a set of figures. For example earnings in a particular week for a group of individuals, ages of a group of people, or output from a set of machines. In this form they convey very little to the reader. We have seen ways of handling data so that a picture can be drawn to convey the main points of the data. Now we wish to describe the data.

We can draw conclusions from data by summarising the data using a measure such as the 'average'. A typical example is in wage negotiations. If the management and unions had to negotiate about every individual's wage then negotiations would be slow, if not impossible. What is often done therefore is to look at the 'average' or 'typical' wage. However these two measures are not necessarily the same, as the following case clearly shows.

Case

Ted Green started his working life as a gardener for the local council. After 10 years he set up his own business, initially doing all the work himself, designing and establishing gardens for new houses. Another 10 years on, he has a thriving business, a lot of new houses are being built and he now employes 5 other people; Bill, a landscape gardener who has taken over the design work; Tom, Jack and Jeff, who are all experienced gardeners and Barry who does labouring work. Ted is now mainly concerned with the administrative task of running the business. He pays himself an annual salary of £18,000 from the business. Remaining profits are ploughed back into the business, Bill is paid £12,000 per annum, and Tom, Jack and Jeff are paid £80 per week. Barry, the labourer, gets £60 per week.

Let's look at the 'average' wage in Ted's firm. So how do we calculate an average:

Firstly: add up all the figures to a total

Then : divide this total by the NUMBER of figures we added together to get our total

So the average of the three numbers 6, 4 and 2 is found by:

Total 6 + 4 + 2 = 12
Number of figures = 3
Average 12 divided by 3 = 4

THIS TYPE OF AVERAGE IS ALSO REFERRED TO AS THE 'MEAN'.

So, to work out the 'mean' or 'average' wage in Ted's firm we first list the wages of the various individuals.

Ted	£18,000 per annum
Bill	£12,000 per annum
Tom	£80 per week
Jack	£80 per week
Jeff	£80 per week
Barry	£60 per week

ACTIVITY 24
Time guide
1 min

To find the average we cannot just add these figures together and divide by 6. Why?

* _____

_____

Some of the amounts are stated as weekly wages and some as annual salaries.

Before we can average the figures they must all be put in the same way, in this case AS ANNUAL WAGES OR WEEKLY WAGES.

Let's convert them all to annual wages.

Ted	£18,000 per annum
Bill	£12,000 per annum
Tom	£ 4,160 per annum (£80 x 52 weeks)
Dick	£ 4,160 per annum (" " ")
Harry	£ 4,160 per annum (" " ")
Barry	£ 3,120 per annum (£60 x 52 weeks)

ACTIVITY 25
Time guide
3 mins

Now we can work out the average. Use a calculator if you want to:

Total * _____

Number of figures * _____

Average * _____

Total £45,600; Number of figures 6; Average £7,600. Therefore the average wage in Ted's firm is £7,600 per annum.

Is this also typical of wages in Ted's firm?
No, it isn't. In fact no-one in the firm earns £7,600 or anywhere near it.

SO AN AVERAGE CAN SOMETIMES BE A MISLEADING FIGURE.

A typical wage would be the wage earned by most of the people in the firm which is £4,160.

THE AVERAGE DOESN'T GIVE US THIS TYPICAL WAGE -
BUT A STATISTIC CALLED THE MODE WILL.

We'll be looking at the Mode in more detail shortly, but first lets get used to the Average - it is a commonly used statistic.

2.1 The Average

We'll start with a case incident and do some calculations:

ACTIVITY 26
Time guide 15 mins

Stan, the supervisor in charge of stock control in a busy office, has found that over a period of 6 weeks the following quantities of stationery were used and he now wants to estimate what the annual usage will be.

Week	1	2	3	4	5	6
Pens	20	18	25	12	24	15
Pencils	10	8	12	14	9	13
A4 paper (sheets)	5500	6500	5440	7000	6450	5950
Typewriter ribbons	2	0	1	1	2	0

You might find this table helpful I have used it to calculate the average for the pens. Do some calculations of your own by completing the table.

	Total	Number of Weeks	Average
Pens	114	6	19
Pencils	*	*	*
A4 Paper	*	*	*
Typewriter Ribbons	*	*	*

The completed table will look like this:

	Total	Number of Weeks	Average
Pens	114	6	19
Pencils	66	6	11
A4 Paper	36840	6	6140
Typewriter Ribbons	6	6	1

You will have noticed that although no typewriter ribbons were used in weeks 2 and 6 we still divided our total by 6 to get our average - we did use 6 ribbons during the six weeks we looked at.

Now that we have found the average useage for these six weeks, if we expect useage to vary in a similar way over a year then we can estimate the year's usage. It will of course not be exactly correct, that is why we call it an 'estimate'. We do expect, however, that our estimate will not be a long way out.

ACTIVITIY 27
Time guide
3 mins

Jot down a reason why an estimate based on these six weeks' figures could be long way out.

* _____

_____

If for any reason these six weeks' usage were not typical of the year, for example, it was a particularly busy period or a particularly quiet period, then it would not be sensible to assume that the year's usage could be based on these six weeks.

In making our estimate, therefore, we must feel fairly confident that the average for the six weeks we have looked at will be close to the average for the year.

If this is a reasonable assumption, then we can estimate annual usage by assuming that every week is an 'average' week. We know that, in fact, very few, if any, weeks will actually hit the average, but over the year we would expect the amounts above and below the average to cancel one another out.

Let's assume in the office in our example there are 50 working weeks in the year. Then for each item we can estimate annual usage by multiplying the average amount for each week by the number of weeks.

Estimated demand for pens for 50 weeks. 50 x 19 = 950

ACTIVITY 28
Time guide
5 mins

Now work out estimated usage for the other three categories.

Pencils *_____

A4 paper *_____

Typewriter ribbons *_____

Pencils 50 x 11 = 550; A4 paper 50 x 6140 = 307000; Typewriter ribbons 50 x 1 = 50;

Having estimated the annual usage it would now be possible to go on and estimate the annual costs of these items or the amount of stock required. Neither of these could be done without first knowing the AVERAGE usage.

So the AVERAGE is a useful statistic because it can summarise a lot of data and describe it in a single figure. We've seen too, that we can make forecasts by taking a little care.

Let's return to our other statistic - the MODE.

2.2 The Mode

Remember the wages in Ted's firm - we said that the mode would give us a "typical" wage but the average wouldn't. So we can say that:

THE MODE IS THE VALUE WHICH OCCURS MOST OFTEN

In Ted's firm, the wage which occurs most often is £4,160 pa - the wage level earned by the highest number of individuals (3 out of 6). Have a go at this next activity before we move on to a case where we need to decide whether to use the Mean or the Mode:

ACTIVITY 29
Time guide
2 mins

The ages of a group of new recruits were as follows

16 20 19 17 17 17 20 17 18

What is:
(a) the average (or mean) * ____

(b) the mode * ____

The total of the ages is 180, the number of recruits is 10; so 180 divided by 10 is 18, so this is the average age. Now the age occurring most often is 17; 4 recruits are this age so 17 is the mode.

The obvious thing to note is that no one is actually aged 18 - so the average is not the most useful statistic. At least when we say the mode is 17 we know that this is the typical age of recruits.

There are other examples where the average wouldn't be a particularly useful measure.

Let's return to our earlier example of Ted Green's business and list the wages and salaries paid:

Ted earned	£18,000 pa
Bill earned	£12,000 pa
Tom earned	£4,160 pa
Dick earned	£4,160 pa
Harry earned	£4,160 pa
Barry earned	£3,120 pa

Suppose Harry asked Ted for a pay rise. Harry would not be pleased to be told that he couldn't have a rise "because" the average pay was £7,600!

This would be a very mistaken way of using the average! The mode is much more useful - if Ted told Harry that he was earning the typical wage then Harry might not be able to object in the same way as before.

Now let's look at a case incident where the mode is a more useful statistic than the average:

ACTIVITY 30
Time guide
5 minutes

Suppose you are in charge of a small training room. One of your responsibilities is computer training. To do this you have a number of mini-computers that trainees can use on a casual drop in basis. You have 10 of the computers which are taking up a lot of space and a lot of maintenance time whch is costly.

You have been asked to see if you could reduce the number of computers but still provide an efficient training service. So you set about gathering data by doing some spot checks on how many computers are in use at any one time. Here's the results of your 20 spot checks - the figures are the numbers of computer in use on each occasion:

4; 2; 10; 10; 4; 3; 4; 2; 9; 4
9; 4; 3; 4; 3; 4; 4; 3; 4; 10;

Now calculate the average;

Total = *_____

Number of figures = *_____

Therefore average = *_____

The mode = *_____

Now we will need to decide between these two statistics noting that the average is 5 (100 divided by 20) and the mode is 4 (the value which occurs most often).

So if we used the average to decide how many computers to keep we'd say 5. But if we used the mode we'd say 4.

Our next activity might help us decide how many computers to keep:

ACTIVITY 31
Time guide
3 mins

Say how many computers you would keep and give one good reason:

How many computers would you keep *_____

Give your reason *_____

_____

We could argue that were we to keep 5 computers there would still be 5 occasions where there would be more trainees than computers. Although the 'queue' would be shorter than if we keep 4 computers, there would still be a queue on the same 5 occasions.

So we must admit, that on most occasions we meet where we can calculate both statistics, we still need to apply our judgement in deciding which one to use.

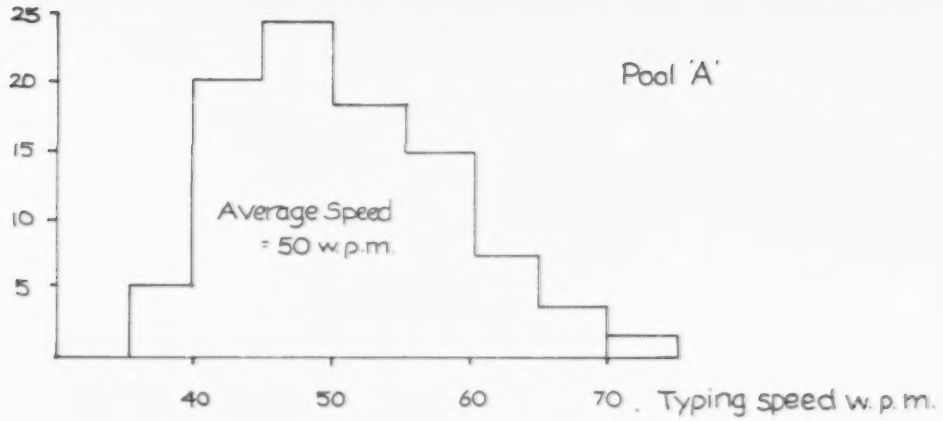
EXTENSION 2
Page 59

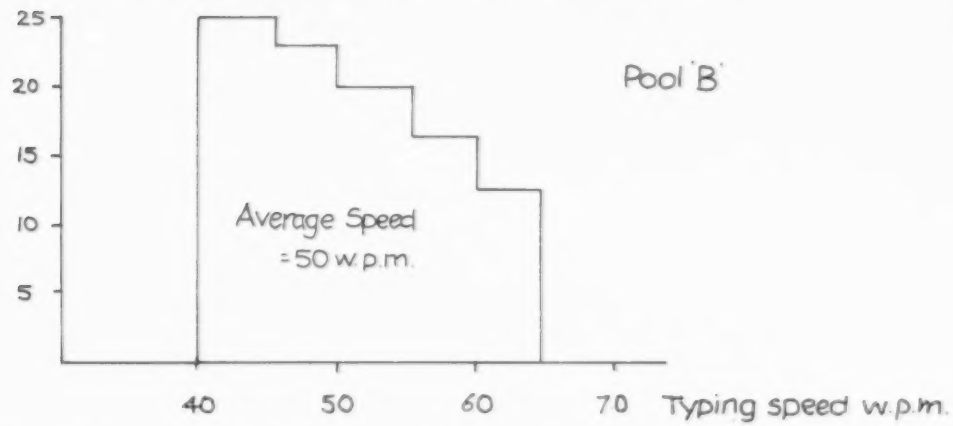
There is another common statistic - the median - which also has its application - but we won't get into this here. You can take up this extension if you are interested.

3 Spread of Data

We have looked at this average and at the mode. These statistics describe the data giving an idea of the general size of the data. It's also useful to have another statistic which tells us of the limits of the data - or the range of values covered.

Let's see what we mean by this by looking at two histograms of the typing speed of typists in two different typing pools.





Now although each typing pool has an overall performance average of 50 words per minute, we can see that the pools are different.

In 'pool A there are 5 typists whose performance is below 40 words per minute. At the other extreme there's 6 who exceed 65 words per minute.

In 'pool B no one has a performance lower than 40 nor higher than 65.

The difference between the two pools is therefore in the Range of performance. By stating the Performance in terms of Average and Range we describe the differences clearly, thus:

	Performance in Words per minute	
	Average	Range
'pool A	50	40
'pool B	50	25

We now have another very simple statistic we can use to describe data.

EXTENSION 4
Page 59

There are other statistics we can use to describe the spread of data - these can be picked up via this extension.

SELF CHECK 5
Time guide
15 mins

Respond by completing each sentence with a suitable word or words.

(1) The mean is another word for the _____.

(2) The most likely or typical figure is the _____.

(3) The range is the difference between _____ and _____ values.

(4) The following are the ages of a group of individuals in the same work team.

23 25 29 30 32 34 35 47 55 64

What is the average age? - *_____

What is the range of ages? - *_____

The answers to this self check are here in the following words, so you'll need to check out your answers carefully. (1) average; (2) mode; (3) highest and lowest; (4) total = 374 average age = 37.4; (3) The range is 41 (64 -23)

4 Summary

* Our statistics for MEASURING DATA helps us to SUMMARISE THE DATA

* The statistics we explored and used were:

  Average (or mean) - Total divided by number of figures

  Mode - the value which occurs most often

* We need careful judgement in deciding which of our statistics to calculate and use.

* We used the range of the figures as a measure of the spread of data

PART D PERFORMANCE CHECKS

1 End Check

Time guide
60 mins

You may review your understanding of the Unit as a whole by completing this group of questions. DON'T GUESS THE ANSWERS - if you're not sure, flick back into the Unit and check before responding.

If you are still unsure then put a question mark against your response before proceeding.

TRUE/FALSE

Respond to each statement by writing TRUE or FALSE in the space provided.

1 Pie charts are useful for showing a large number of divisions. _____

2 Pie charts are better than bar charts if we wish to show how a total is shared between categories. _____

3 Tables are the best way of showing detailed figures. _____

4 A histogram is the same as a bar chart. _____

5 Graphs are only used when two sets of data are being compared. _____

6 The mode tells us the 'typical' or the value occurring most often. _____

7 We find the mean of a set of figures by adding all the values together and dividing by the number of values. _____

8 The mean is always higher than the mode. _____

COMPLETION

Respond by completing each sentence with a suitable word or words.

9 Diagrams are used to give figures a visual _____.

10 Pie charts show how a total amount is _____ between different categories.

11 Pictograms are easy to understand and have a strong _____.

12 Two-directional bar charts show the _____ from one period to another.

13 A _____ can be used to display data which changes over time.

14 The _____ is another term used for the average.

15 The _____ is the most frequent value occurring in a set of figures.

16 The _____ is the difference between the highest and the lowest figures.

MULTIPLE CHOICE

Respond to each question by putting a mark against the ONE answer which is most correct.

17 Which ONE of the following statements describes a bar chart.

(a) a diagram showing how a total amount is shared between categories

(b) a diagram showing the amount falling into different categories

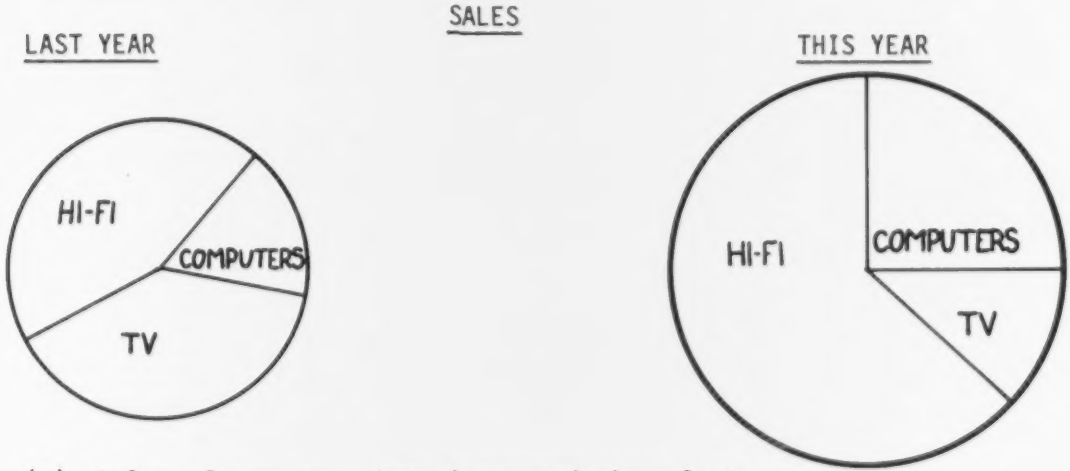
(c) a diagram showing the proportion of the total falling into different categories

(d) a diagram showing data over a period of time

18 Which ONE of the following conclusions could be correctly drawn from this diagram.

WILKES ELECTRONICS LTD

SALES



(a) Sales of computers have increased since last year

(b) Sales of HI-FI have grown since last year

(c) Sales of TV have decreased since last year

(d) Sales of computers are higher than sales of HI-FI this year.

19 A histogram can be distinguished from a bar chart because

(a) the bars are joined together side by side

(b) a bar chart shows changes from one period to another.

(c) the bars are not shaded

(d) there are more bars in a histogram

20 Look at the figures and then decide which ONE of the following statements is correct.

2 5 7 7 11 13 13 13 15 21

(a) The median is 13

(b) The mode is 7

(c) The mean is 12

(d) The range is 19

21 From the following histogram which statement is true.

(a) Less than half employees are aged under 35

(b) There are more employees under 20 than 55 or over.

(c) 10 employees are aged between 15 and 20

(d) 80 employees are aged between 25 and 39

22 A two-directional bar chart is

(a) a bar chart showing two different categories

(b) two bar charts combined

(c) a bar chart showing changes from a previous period

(d) a bar chart in two different colours

END CHECK - Checkout

Audio Tape Side 2 Time guide 35 mins

The answers and explanations for these End Checks are on Side 2 of the Audio Tape. Have your responses with you as you play this tape. As you listen you can check out how well you have done and make notes as you proceed.

53

2 Tutor Check

Time guide 60 mins

Read the following case, then deal with the accompanying questions.

Case

The wages section for Windows Ltd a medium-sized manufacturing company is under some pressure of work since a new contract has meant an increase of staff from 700 to 800. The problem is that most of the new employees have opted to be paid by cash rather than direct into a bank account. Payment by cash creates a bottleneck in the wages department for a full day every week whereas very little work is created by payment direct to a Bank or a Building Society, as this is handled by computer.

The section head has prepared the following pie-charts and bar-charts to demonstrate the problem to all staff. The company are considering an incentive scheme to persuade weekly paid employees to accept fortnightly payment into a bank account.

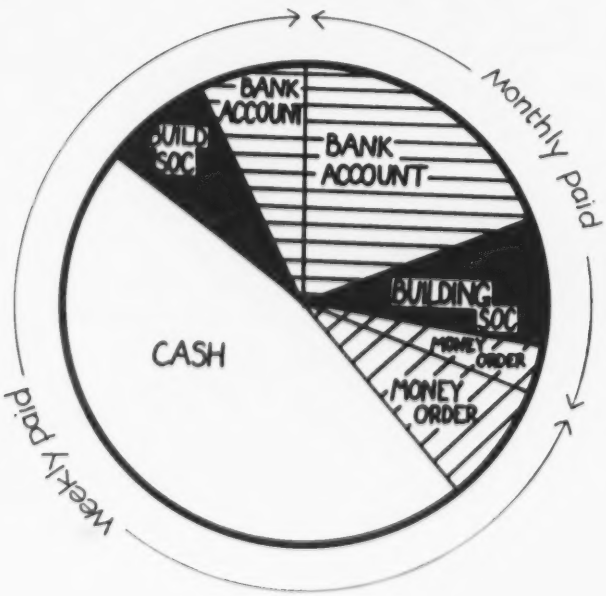
1 Pie Charts

WINDOWS LIMITED

METHODS OF PAYMENT

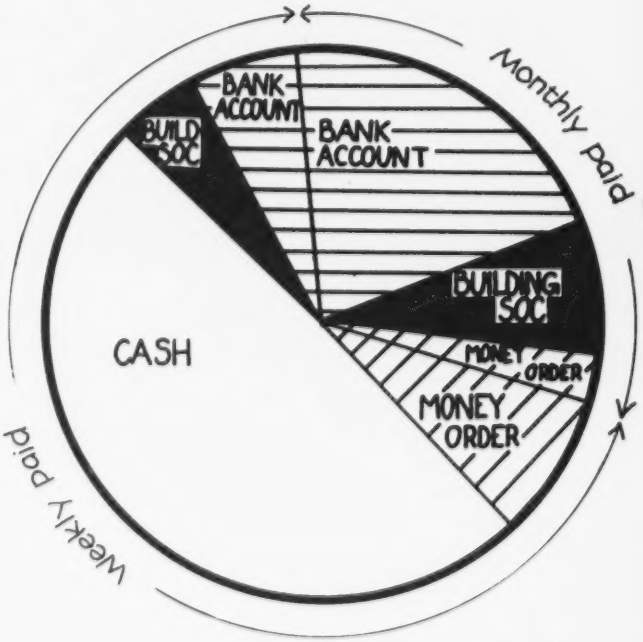
BEFORE NEW CONTRACT

700 employed



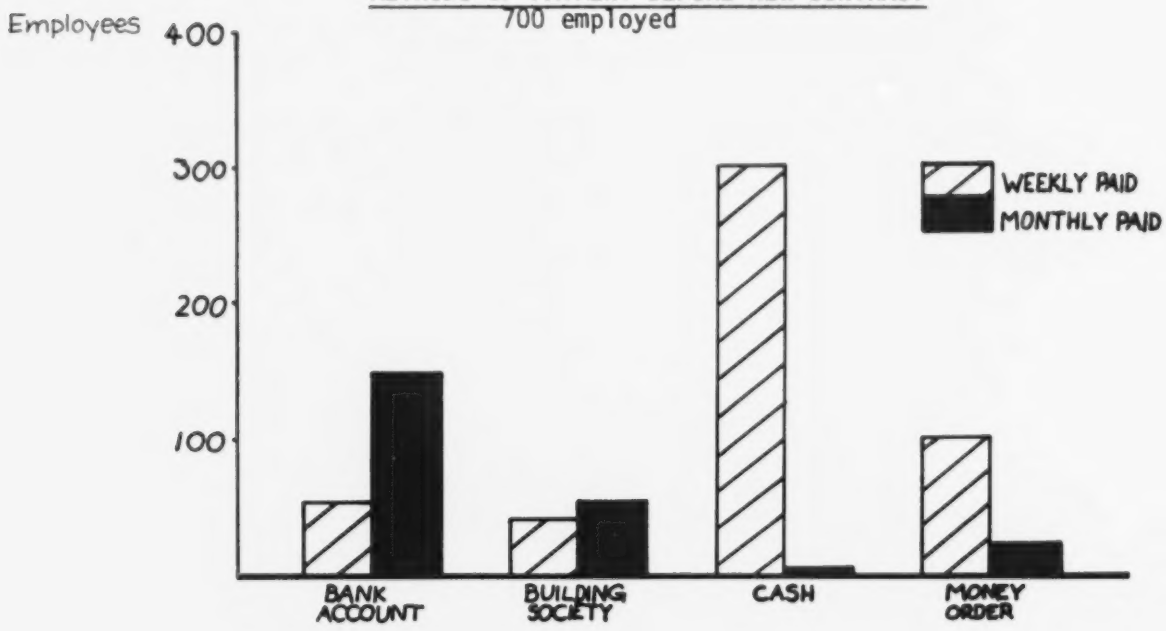
AFTER NEW CONTRACT

800 employed

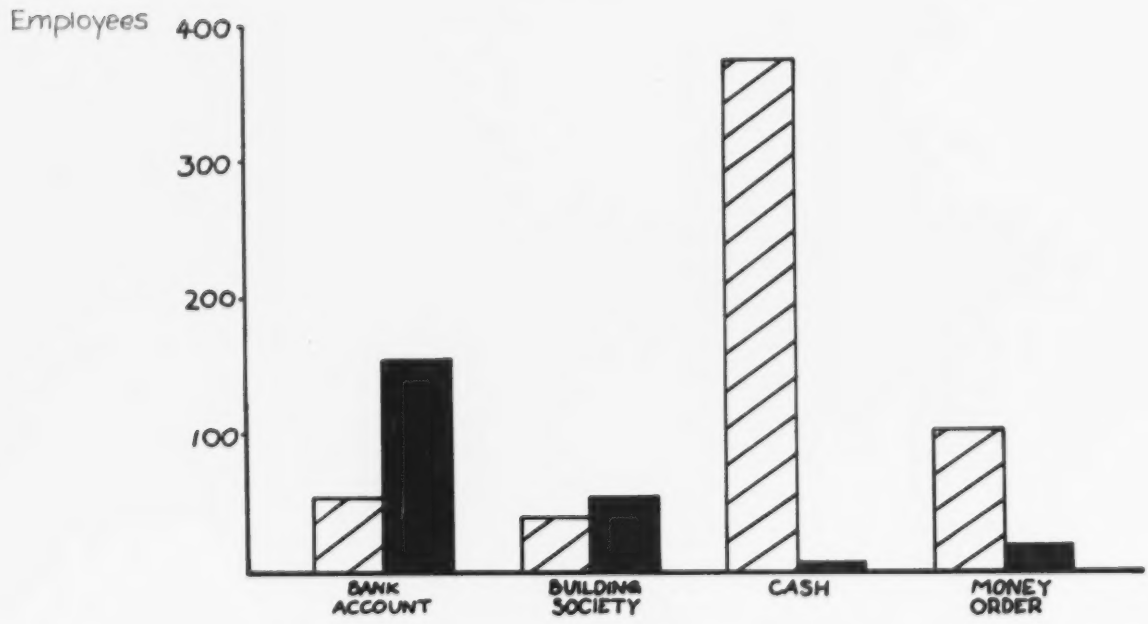


2 Bar Charts

METHODS OF PAYMENT BEFORE NEW CONTRACT
700 employed



METHODS OF PAYMENT AFTER NEW CONTRACT
800 employed



1 From the pie charts

(a) What method of payment is used for the majority of weekly paid employees.

(b) What method of payment is used for the majority of monthly paid staff.

2 From the bar charts:

Give approximate answers:

(a) How many people were paid in cash before the new contract.

(b) How many were paid by other methods before the new contract.

(c) How many people are now paid in cash.

(d) How many are now paid by other methods.

(e) What proportion of weekly paid employees are paid in cash.

(f) What proportion of all employees are paid in cash.

3 Which set of diagrams, the pie charts or the bar charts, do you consider best illustrates the problems of the wages section are having? Give a short reason for your answer.

Send to tutor

Now get your answers to your study tutor either by post or handing it over personally. You will receive your tutor's assessment and comment back through the post as soon as can be managed.

3 Work-based Project

Time guide 60 mins

This is an exercise based on data collected at your place of work. You are asked to examine the distance people travel to work and the mode of travel they use. For each member of your section record the distance the individual travels to work to the nearest mile and the method he or she uses to travel. If you supervise a very small number of individuals see if you can collect the same information for a neighbouring section or other people you work with. You should make sure you have data for at least 8 individuals, more if possible.

Once you have collected your data:

1 Calculate the average distance individuals travel to work.

2 Calculate the median distance individuals travel to work.

3 If there is a difference between (1) and (2) explain why.

4 Draw a bar chart showing the ways in which individuals travel to work, eg bus, car, walk etc.

5 Draw a histogram showing the distance individuals travel to work.

eg under 1 mile, 1 mile or over and under 2 miles, 2 miles and under 3, 3 miles and over.

If everyone travels shorter or longer distances you can vary the groupings used.

Send to tutor

Now get your answers to your study tutor either by post or handing it over personally. You will receive your tutor's assessment and comment back through the post as soon as can be managed.

PART E UNIT REVIEW

1 Return to objectives

Having completed your work on this unit let's review how you feel about each of our four objectives. I will repeat them here and add comments.

You should be BETTER ABLE TO:

* UNDERSTAND INFORMATION DISPLAYED IN CHARTS, TABLES AND GRAPHS.

I'm sure that this is not the first time you have seen information displayed by using various kinds of diagrams. Now that you have looked in more detail about how they are constructed you're sure to be able to "read" or understand them better. if you are now better able to draw certain conclusions from them then you have achieved this objective.

* PRODUCE CHARTS, TABLES AND GRAPHS FROM FIGURES WHICH YOU HAVE COLLECTED.

Having reminded yourself about what goes into the construction of these various diagrams then, no doubt, you have become familiar in being able to draw them up. Using figures of your own to construct diagrams is a measure of your achievement on this objective.

* CHOOSE SUITABLE DIAGRAMS TO COMPARE DIFFERENT SETS OF FIGURES.

This skill of selecting suitable kinds of diagram to draw up, can only arise from analysis and practice. You have done both, and thus you'll be more able to select the right form of diagram for particular purposes. So you will have achieved this objective.

* CALCULATE SUITABLE MEASURES TO SUMMARISE A LARGE AMOUNT OF INFORMATION.

You have moved from visual presentation of data onto mathematical means of showing the data. You will have learned how to summarise data by using Averages, Modes and Ranges, or you will be more practiced if you already knew about them. Developing your statistical skills in this way means you have achieved this objective too.

I think it's fair to claim that achieving our four objectives will have increased your skills and confidence in using figures.

I hope that the work you have done way enjoyable and useful enough to encourage you to continue in your studies.

2 Extensions

EXTENSION 1	Book:	Using Statistics in Business Volume 1
	Author:	P Clark
	Publisher:	Pan Breakthrough Series
EXTENSION 2	Book:	Choice Unit 43 Descriptive Statistics
	Author:	Ysanne M Carlisle
	Publisher:	The Northern Regional Management Centre
EXTENSION 3	Book:	Choice Unit 32 Using Graphs
	Author:	Linda Carr
	Publisher:	The Northern Regional Management Centre
EXTENSION 4	Book:	Mastering Statistics
	Author:	T Hannigan
	Publisher:	MacMillan Education

These extension opportunities can all be taken up via your Support Centre.

They will either have the materials or will arrange that you have access to the materials. However it may be more convenient to check out the materials with your Personnel or Training people at work - they may well give you access. There are other good reasons for approaching your own people, for example they will become aware of your interest and you can involve them in your development.

3 References

REFERENCE 1 Book: An Introduction to Statistics

Author: A Hall

Publisher:

Page 118

REFERENCE 2 Book: Using Statistics in Business Volume 2

Author: Peter Clark

Publisher: Pan Breakthrough
Page 219

REFERENCE 3 Book: Mastering Statistics

Author: T Hannigan

Publisher: MacMillan Education
Page 90

REFERENCE 4 Book: Using Statistics in Business Volume 1

Author: Peter Clark

Publisher: Pan Breakthrough
Page 247

These references can all be taken up via your Support Centre. They will either have the materials or will arrange that you have access to the materials. However it may be more convenient to check out the materials with your Personnel or Training people at work - they may well give you access. There are other good reasons for approaching your own people, for example they will become more aware of your interest and you can involve them in your development.

If you do wish to make use of these references then don't think that you must read them right through. Just dip into them for a slightly wider treatment of the topic raised by the unit.

I should warn that the language and style of the writing is often difficult to cope with. So don't struggle with it too much. Do what I do when in difficulty, put the book back on the shelf and find a better one!

THE CHOICE SERIES

PRINCIPLES AND PRACTICE OF SUPERVISION

11 Needs and Rewards
12 Enriching Work
13 Workteams
14 Team Leading
15 Leading Change
16 Organisation Systems
17 Supervising in the System
18 Supervising with Authority
19 Workplace Control
20 Taking Decisions

TECHNICAL ASPECTS OF SUPERVISION

30 Looking at Figures
31 Basic Planning
32 Using Figures
33 Work and Method Study
34 Easy Statistics
35 Quality Control
36 Plant Capability
37 Controlling Output
38 Value Engineering
39 Quality Circles
40 Computers
41 Stores Control
42 Managing Time
43 Descriptive Statistics

COMMUNICATION

60 Communicating
61 Speaking Skills
62 Writing Skills
63 Communication Systems
64 Orders and Instructions

ECONOMIC AND FINANCIAL ASPECTS

70 Accounting for Money
71 Control via Budgets
72 Cost Reduction
73 Wage Payment Systems
74 The National Economy

INDUSTRIAL RELATIONS

80 Training Plans
81 Training Sessions
82 Discipline and the Law
83 Industrial Relations
84 Health and Safety
85 Industrial Relations in Action
86 Equality at Work
87 Hiring People
88 Supervising and the Law
89 Industrial Relations and the Law